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# Solar wind control of Jovian auroral emissions

Patrick H. M. Galopeau

Centre d'Etude des Environnements Terrestres et Planétaires/Université de Versailles Saint-Quentin-en-Yvelines/Institut Pierre-Simon Laplace, CNRS UMR 8639, Vélizy, France

Mohammed Y. Boudjada

Space Research Institute, Austrian Academy of Sciences, Graz, Austria

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[1] The combination of Galileo/PWS and Wind/WAVES observations allows the study of the flux density variation of the Jovian hectometric emissions (HOM) observed from 31 August 1996 until 24 October 1996. It is found that the HOM emission presents periodic features; each one is called a "HOM event." Such episodic emissions were concurrently observed by both experiments with similar spectral characteristics. The fluctuations of the Jovian hectometric emissions and the solar wind parameters are found to exhibit quasi-similar variations when a time lag of about 153 days is taken into consideration. Also, "HOM enhancements," like the "injection events" first reported by Mauk et al. (1997), are found to occur at some specific longitudes. The occurrence of these magnetospheric events increases at two "active longitudes," i.e.,  $45^\circ$  CML and  $180^\circ$  CML. The solar wind seems to be at the origin of both phenomena. Solar particles go through the polar regions where they interact with the Jovian magnetic field and give rise in the auroral and equatorial regions to an increase of Jovian hectometric emissions and/or injection events.

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## 1. Introduction

[2] The Jovian hectometric emission (HOM) was originally discovered by Earth orbiting spacecraft [Brown, 1974; Desch and Carr, 1974]. This emission can only be observed from space because of the critical frequency cutoff of the Earth's ionosphere. Several missions, like Voyager [Warwick et al., 1977], Ulysses [Stone et al., 1992], and Galileo [Gurnett et al., 1992], lead to a better knowledge of the Jovian hectometric characteristics. It consists of relatively smoothly varying emission in the frequency range from a few tens of kHz to more than 3 MHz with a peak in intensity at about 1 MHz. However the high-frequency limit is not well determined but certainly reaches up to 5.8 MHz [Kurth et al., 1997], and it is suggested to be as high as 7 MHz [Barrow and Desch, 1989]. The appearance and the morphology of the features are dependent on the Jovicentric latitude of the spacecraft [Alexander et al., 1979] and are modulated at the rotation period of the planet Jupiter. The rotation profile consists of two regions of emission symmetrically located around the longitude of the north magnetic dipole. The persistent features that are particularly noticeable are the high occurrence probability regions near  $110^\circ$  and  $333^\circ$  of Central Meridian Longitudes (CML). It appears that this emission is emitted from high Jovian magnetic latitudes at frequencies close to or just above the local gyrofrequency [Barrow, 1991]. The HOM is beamed into

a radiation pattern believed to have the form of hollow cone with apex at the point of emission and axis tangent to the magnetic field direction.

[3] Previous studies clearly show that the HOM energy is correlated with the solar wind density, its dynamic pressure and its kinetic energy flux [Desch and Barrow, 1984; Barrow and Desch, 1989; Rabl et al., 1990; Gurnett et al., 2002]. However the correlation coefficient for the solar wind is only found to be of about 26% [Desch and Barrow, 1984]. This value shows that the control is not as strong as that of the solar wind control over the terrestrial or Saturnian kilometric radiations. In the case of the Earth, it is the solar wind speed that influences the radio emission [Gallagher and D'Angelo, 1981], and for Saturn it is the solar wind density and/or the ram pressure [Desch and Rucker, 1983]. Nevertheless there is significant correlation between HOM energy and solar wind density, and the cross correlation between these two previous parameters shows a periodicity of 13 days (half solar rotation) which is inherent to the solar wind density periodicity [Barrow and Desch, 1989].

[4] Earth-like "substorms" occurring in the Jovian magnetosphere were first reported by Mauk et al. [1997] using the Energetic Particle Detector (EPD) experiment on board Galileo spacecraft. The authors showed dynamic injections of charged particles within Jupiter's inner magnetosphere. These injections are found to be clustered in time and analogous to what often happens during well-known magnetic storms that occur in the Earth's magnetosphere [Mauk et al., 1999]. Similar plasma and radio "substorms" waves were also recorded by the Plasma Waves (PWS) experiment

on board Galileo spacecraft [Louarn *et al.*, 1998]. They are characterized by intensifications and enhancements of the auroral radio emissions and the creation of new sources of radiations in the outer regions. From an extended PWS data set, Louarn *et al.* [2000] suggested that the energetic events are linked to an instability developing in the external part of the Io torus or in the close magnetodisc that sporadically injects new plasma populations in the more distant magnetodisc. A multi-instrument study, combining EPD, PWS and the magnetometer on board Galileo, show that the active region where the large-scale disturbance initially occurs does not corotate, and would even be almost fixed in local time. During such an event, an energy of  $\sim 10^{12}$  W is transferred to the electron population and the global phenomenon seems to be a sporadic dissipation of a part of the Io torus rotational energy [Louarn *et al.*, 2001]. The authors define a region of limited longitude extension where the density of energetic particles is found to be very large. This region corresponds to the source of the narrowband kilometric radiation (the so-called nKOM).

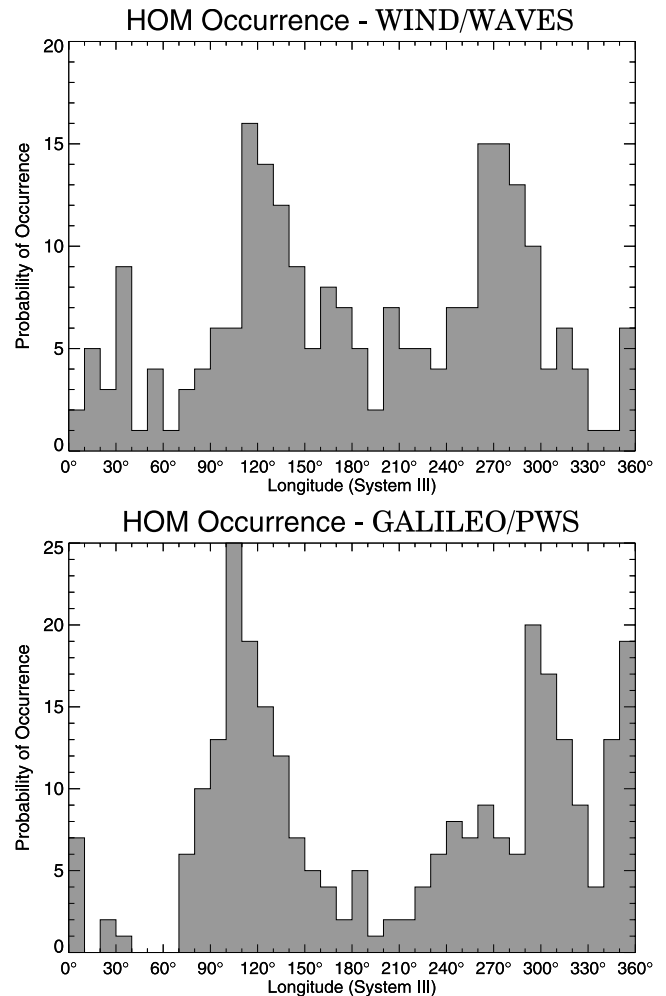
## 2. Observation of HOM by WAVES and PWS

### 2.1. WAVES and PWS Experiments

[5] The data used in this investigation were acquired by the radio experiment (WAVES) and the plasma wave experiment (PWS) on board the Wind and Galileo spacecraft, respectively. The Wind satellite is mainly orbiting in the vicinity of the Earth's magnetosphere whereas Galileo spacecraft is describing elliptical trajectories inside the magnetosphere of Jupiter. For the study of the Jovian hectometric emissions, we have selected a time period from 31 August 1996, to 24 October 1996. It corresponds to Galileo's second orbit (hereafter called G2 orbit), the closest approach of which, (i.e., the perijove), was on 7 September 1996, 1337 UT at a distance of about 10.7 Jupiter radii. The PWS experiment [Gurnett *et al.*, 1992] on board Galileo consists of four different sweep frequency receivers that cover a frequency range from 5.6 Hz to 5.6 MHz. For this study, we analyze the data recorded by the high-frequency receiver (HFR) between 101 kHz to 5.6 MHz. On the Wind satellite we investigate the data recorded by the superheterodyne receiver RAD1 which has 16 discrete logarithmically spaced frequency channels ranging from 20 to 1040 kHz [Bougeret *et al.*, 1995]. During the "G2 orbit", the Wind satellite was principally on the day side of the Earth's magnetosphere, and only for few days (on 10 September and 1 October) the satellite was on the nightside.

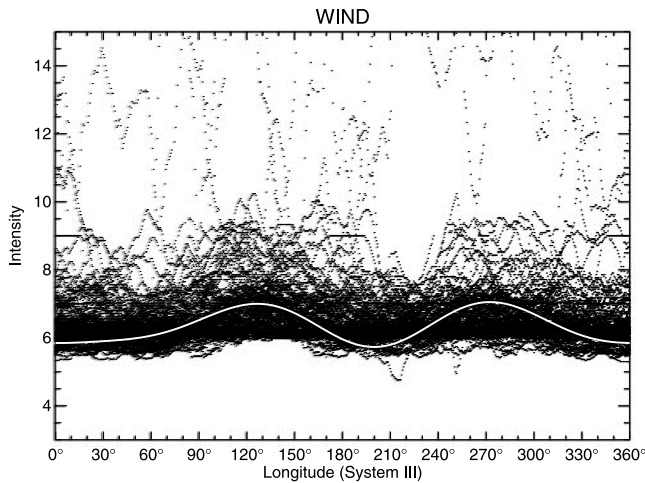
### 2.2. Occurrence Probability

[6] Figure 1 shows the HOM occurrence probability versus the system III central meridian longitude (CML) for Wind/WAVES and Galileo/PWS. This longitude parameter is associated to the Jovian sidereal rotation which lasts 9.924920 hr. The occurrence probability is defined in a similar way for both experiments: we have noted the time where the level of the emissions is higher than the noise level ( $\sim 5$ – $6$  dB for WAVES and  $30$ – $40$  dB for PWS), for each time we have calculated the corresponding CML, finally the histograms show the number of data points for each bin of  $10^\circ$  of CML. Two main maxima are observed at CML  $\sim 120^\circ$  and CML  $\sim 300^\circ$  and corre-



**Figure 1.** Occurrence probability of the Jovian hectometric emissions versus the central meridian longitude (CML). These histograms are derived from data recorded by the Wind/WAVES and Galileo/PWS experiments for the same time period.

spond to a radiation, beamed in a hollow cone, coming respectively from the northern and the southern hemispheres. Despite identical time coverage, some occurrence features appear to be different between the two spacecraft. In particular the probability of occurrence is higher on Galileo/PWS experiment because of the close distance to Jupiter. The HOM occurrence in Figure 1 (bottom) is similar to the results published by Menietti *et al.* [1999]. In addition the gap near CML  $\sim 200^\circ$  is clearly seen on Galileo/PWS experiment, and less visible on Wind. Furthermore some occurrence peaks are present on Wind or on Galileo, but not on both spacecraft. Boudjada *et al.* [2001] reported on the main common and different features between the HOM beam observed by Wind and Galileo spacecraft. The authors showed that the HOM spectral and occurrence discrepancies are due to three fundamental constraints: the geometrical configurations of the HOM hollow cones with regard to the position and the Jovicentric latitude of the satellite, and the HOM source locations which are fixed at local time.



**Figure 2.** Variation of the hectometric relative intensity measured by Wind versus the central meridian longitude. A quasi-sinusoidal modulation, derived from a least-square fit, is displayed by a white curve.

### 2.3. Relative Intensity

[7] From Wind and Galileo dynamic spectra, it is possible to derive the variation of the HOM relative intensity at frequencies around 800 kHz. As shown in Figure 2, the intensity measured by the Wind/WAVES experiment presents a quasi-sinusoidal modulation as a function of the CML. The two maxima of the sinusoid are related to the hollow cones emitted from both Jovian hemispheres. It is important to note that the sinusoid amplitudes are, on average, about a few dB. However, one can see that sometimes the intensity is much more intense and can reach values in the order of 12 or 14 dB. Such high intensities, which have no modulation behavior, are mainly due to the contributions of the terrestrial hectometric emissions and the solar activities. In the next section we focus on the HOM emission coming from Jupiter, in particular the episodic hectometric enhancements.

## 3. Features of “HOM Events”

### 3.1. Intensity and Time Duration

[8] During Galileo’s second orbit, several enhancement phases of the hectometric emissions took place in the Jovian magnetosphere. Figure 3 (top and bottom) displays the variation of the HOM relative intensity for both spacecraft. The trajectory of Wind was usually in the vicinity of the Earth, so the distance to Jupiter was always quasi-constant and in the order of 4 AU. Meanwhile Galileo was orbiting inside the Jovian magnetosphere with a perijove and an apojove in the order of  $11 R_J$  and  $113 R_J$ , respectively ( $R_J = 71,318$  km). In order to make a comparative study between the two spacecraft, we compute the average flux density over each Jovian rotation. This “demodulation” is needed by the fact that Wind and Galileo are generally not located at the same Jovian longitude. In the case of the Galileo data, we normalize the observed radio flux to a distance of  $60 R_J$ . Both spacecraft have recorded enhancement phases, called hereafter “HOM events,” with a time duration, on average, of about a few days. In the case of the Galileo/PWS

experiment, these events were found to be more intense when the spacecraft is far from the planet, and less intense at the perijove. As shown in Figure 3 (top), the level of the intensity measured on 7 September (at the perijove) is nearly 10 dB below the level observed far from the planet, more than one week later. The maxima of the average intensity were in the range from 50 dB to 75 dB with a background noise in the order of 25 dB. The first and the longest period of HOM enhancement was observed in the second week of September (10–17 September 1996) with a maximum level of intensity on 12 September. The last “HOM event” was observed between 18 and 22 October 1996. Table 1 gives a summary of some orbital key parameters for the Galileo spacecraft. The geometrical configurations of the Sun, Jupiter and Galileo are also listed and are described by the subsolar longitude angle.

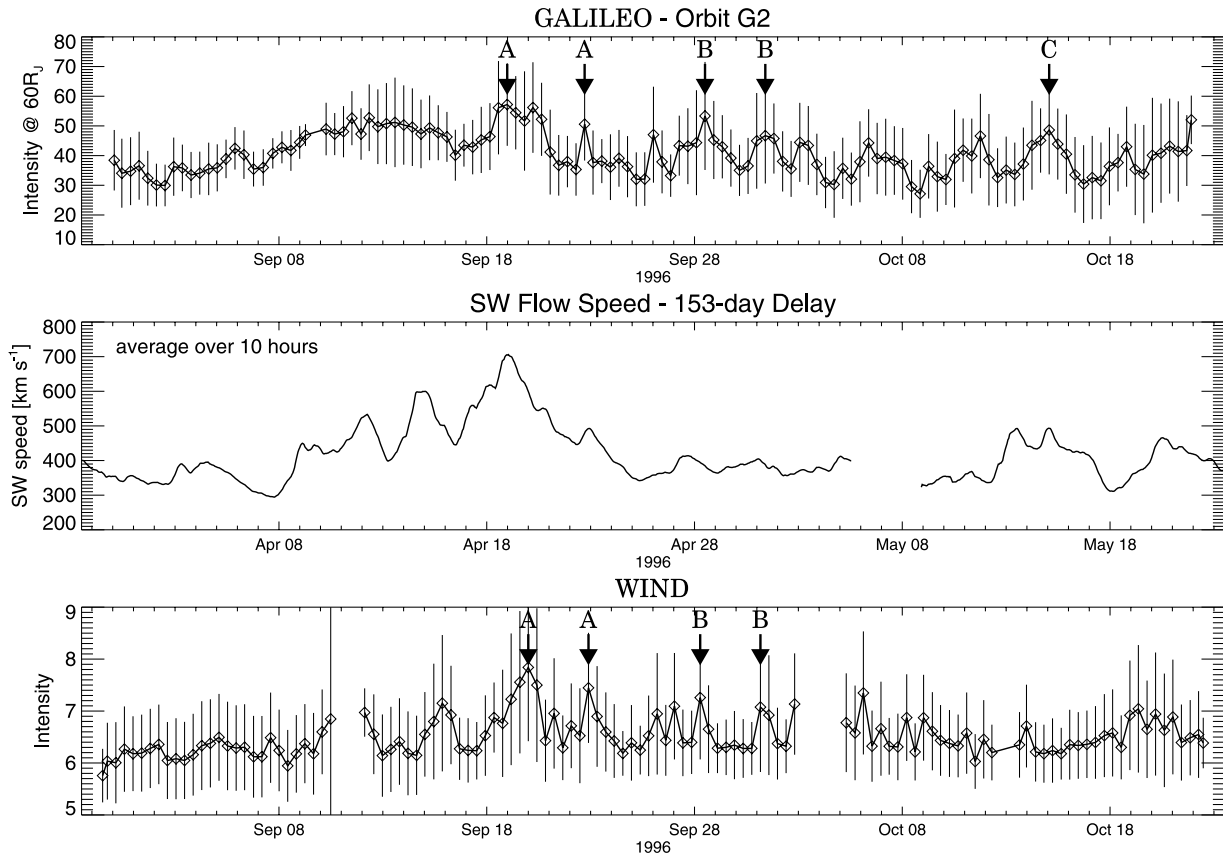
### 3.2. Role of the Geometrical Configuration

[9] In the following we pay attention to the enhancement of the Jovian hectometric emissions observed by only one or both spacecraft. Figure 3 shows the three types of events which can be observed with a time lag of about a few hours (event indicated by A), almost simultaneously by both spacecraft (event indicated by B), or recorded only by one spacecraft (event indicated by C). For example, on 6 September 1996, Wind and Galileo were almost aligned which means that both spacecraft were sensitive to the same HOM flux increase. However in this particular situation a long “HOM event” was recorded by Galileo whereas the radio intensity level was found to be very weak by the Wind satellite. The periods where Wind was on the nightside of the Earth (i.e., 11 September and 5 October 1996) are not taken into consideration because of the presence of radio emissions principally due to the terrestrial environment. Table 2 lists the main orbital parameters of Galileo for the selected events.

[10] It is important to note that the main occurrence peaks were observed when the angle Sun-Jupiter-Galileo was between  $170^\circ$  and  $123^\circ$ . This means that, during this period, Galileo was traveling from the nightside of the planet toward the night-morning sector of the magnetosphere, i.e., from 0100 MLT to 0400 MLT. Moreover, Galileo and Wind were nearly in opposite direction with regards to Jupiter, and then looking totally at different longitudes. On the other hand we find that, for the Galileo observations, the CML associated to the intensity peaks of “HOM events” are, on average, in the order of  $180^\circ$ . This value could be mainly due to the demodulation of the observed HOM emissions during the data processing.

[11] For the considered period, the common hectometric enhancement phases were observed at two opportunities. The common events are shown in Figure 3 and they are observed on 29 September and 1 October 1996, with time durations of about 35 hours and 48 hours, respectively. Therefore the average period of the common “HOM events” is about 41.5 hours, which corresponds to more than four Jovian rotations. In these cases, the Wind satellite was mainly in the dayside of the Earth at a distance at least of about 50 Earth radii. There is a time lag of about a few hours between the peaks observed by Galileo and Wind. Also the most intense “HOM event” was observed on 19 September 1996.





**Figure 3.** (top) Variation of the hectometric relative intensity measured by Galileo as a function of the time. The intensity (at 800 kHz with a time resolution of 0.8 min) has been normalized to a distance of  $60 R_J$  and averaged over each Jovian rotation. The vertical bars indicate the standard deviation over each rotation. (middle) Variation of the solar wind flow speed, measured near the Earth's orbit by Wind/SWE, as a function of the time, moved forward 153 days. The data have been averaged over 10 hours. (bottom) Variation of the hectometric intensity measured by Wind for the same time period. The intensity (at 680 kHz manually picked every 1 min) has been averaged over each Jovian rotation. “HOM events” are marked by arrows and observed by Galileo and Wind with a time lag (indicated by A), almost simultaneously by both spacecraft (indicated by B), and only by Galileo (indicated by C).

[12] On 15 October 1996, the Galileo spacecraft observed an enhancement of HOM intensity while the Wind satellite showed very little hectometric emission. This particular event was recorded in the early morning of the Jovian magnetosphere, more precisely around 0400 MLT. The Wind satellite was mainly on the dayside of the Earth at a distance in the order of 100 Earth radii.

### 3.3. Correlation With the Solar Wind Parameters

[13] Several previous studies, in particular those based on Voyager observations, have shown that some parameters of the solar wind controlled the hectometric emissions. In the case of Galileo, we have no possibility to get in situ measurements of the solar wind parameters in the vicinity of the Jovian magnetosphere. The main reason is the fact that Galileo orbits are located inside the magnetosphere. For the study of the relationship between the solar wind parameters and the hectometric intensity, we use data recorded by the Solar Wind Experiment (SWE) on board the Wind satellite. In order to be consistent with the radio data and to have the same time resolution (one Jovian rotation), the SWE data have been averaged over a period of 10 hours.

Then we correlate the hectometric flux density observed by each spacecraft with some solar wind key parameters recorded several weeks earlier. Table 3 lists three solar wind parameters, the maximum value of the correlation coefficient and the corresponding time lag. We find that several solar wind parameters present a correlation coefficient higher than 40% when we consider a time lag of 153 days. Figure 3 clearly shows that the increases and decreases of the hectometric relative intensities measured by Galileo and

**Table 1.** Orbital Key Parameters of the Galileo Spacecraft Taking Into Consideration the Geometrical Configuration of the Satellite With Regard to the Sun and Jupiter

Date 1996	Time	Range, $R_J$	Subsolar Longitude	Magnetic Latitude	Geometry <sup>a</sup>
31 Aug.	0030	65.71	98°	−8.5°	quadrature
7 Sep.	0130	12.70	0°	−9.2°	aligned
7 Sep.	2215	11.80	270°	−4.0°	quadrature
11 Sep.	1030	41.70	180°	−9.2°	aligned

<sup>a</sup>Geometrical configuration Sun-Jupiter-Galileo.

**Table 2.** Comparative Spectral Features of the “HOM Events” Recorded Simultaneously, or With a Short Time Difference, by Only One or Both Spacecraft

Date 1996	Time	Level, dB	Range, $R_J$	Subsolar Longitude	CML <sup>a</sup>	Magnetic Latitude	Jovigraphic Latitude	Status
19 Sep.	1141	57.20	55	168°	185°	−10.0°	−0.5°	shifted
23 Sep.	0505	50.58	92	148°	177°	−10.0°	−0.5°	shifted
29 Sep.	0010	53.35	107	140°	181°	+8.4°	−0.5°	common
1 Oct.	2146	46.73	110	137°	178°	+8.3°	−0.5°	common
15 Oct.	1342	48.61	108	124°	182°	+8.5°	−0.5°	Galileo

<sup>a</sup>Central meridian longitude (System III).

Wind are similar to the fluctuation of the solar wind flow speed.

[14] It comes from these correlations that the HOM intensity is linked to the solar wind parameter variations. The best correlation is obtained for a delay of 153 days and the absolute value of the coefficients is in the range 38%–62%. It is remarkable that the solar wind flow speed is found with a coefficient of correlation higher than 60%.

## 4. Discussion

[15] We have analyzed the Jovian hectometric emissions (HOM) observed simultaneously by two spacecraft orbiting close and far from the Jovian magnetosphere. We show several common features inferred from the HOM relative intensity variations. These features are called hectometric enhancement phases, or “HOM events.” The investigation of those events leads to a better understanding of the physical conditions occurring in the Jovian magnetosphere during such particular circumstances. The most interesting outcome of our analysis is the presence of a strong correlation between the solar wind parameters and the Jovian hectometric emissions. In the following we discuss our findings and how they are related to the previous investigations.

### 4.1. Solar Wind Control of the Jovian Hectometric “Events”

[16] The most significant result of our investigation is the presence of a strong correlation between the solar wind and the intensity of the radio emission during the Jovian hectometric events. All previous studies [see Barrow and Desch, 1989, and references therein] have shown that some solar wind parameters can be correlated to the hectometric intensity, and the coefficient of correlation was found to be less than 30%. From our investigation, we show that the three main solar wind parameters (i.e., the flow speed, the ion density, and the temperature) are significantly correlated to the Jovian hectometric emissions approximatively observed by both spacecraft. The best correlation is obtained when we take into consideration a delay of 153 days. This delay corresponds to the time needed by the solar wind to first reach Jupiter and then penetrate into the magnetosphere of the planet and affect the radio emission. We believe that the HOM control by the solar wind could be the result of two principal causes. The first one is associated to the minimum of solar activity which occurred in October of the same year. This means that the motion of solar energetic particles through the interplanetary medium were not disturbed by a large solar activity. However several studies have reported that a major interest during the year 1996 was

the timing of solar minimum, the point beyond which the new cycle will start to rise. The rise in the June smoothed sunspot number may make the month of May be the solar minimum and hence the new solar cycle (cycle 23). The second cause is linked to the good opportunity to have a spacecraft like Galileo which was orbiting inside the Jovian magnetosphere. This leads to a correct coverage at unusual magnetic local time of different sectors of the Jovian magnetosphere. On the contrary, previous missions, like Voyager or Ulysses, faced only part of the magnetosphere of the planet. Of course, the position of the Wind satellite is also significant but it only covers the emissions occurring on the dayside of the planet.

### 4.2. “Injections” in the Jovian Magnetosphere

[17] According to the study of Mauk *et al.* [1999], the injections of charged particles into Jupiter’s inner magnetosphere are linked to specific central meridian longitudes. Mauk *et al.* [1999, Figure 12 (top)] showed the injection signature events versus the central meridian longitude as recorded by the EPD experiment. One can see that the number of events start to increase at two particular longitudes: 45° CML and 180° CML. Their investigations were founded on statistical studies of specific days of observation in 1997 (261, 178, 94, 51) and in 1996 (354, 311, 252). Only one event observed by the EPD experiment belong to Galileo’s second orbit, i.e., 1996/252. Louarn *et al.* [2000] explained the emission may be related to a process of plasma sheet thinning or torus enhancement that occurs over time. More interesting in [Mauk *et al.*, 1999] investigations is the particular values of these central meridian longitudes. The analysis of the occurrence probability of the Jovian hectometric emissions (see Figure 1) as observed by Wind and Galileo satellites shows similar features in CML. One can note that the HOM occurrence starts at these two particular longitudes. This is clearly seen on the Galileo HOM occurrence where the emission is totally absent between 40° CML and 60° CML, and very weak from 180° to 200° CML. These two particular “gap in longitude”

**Table 3.** Summary of the Correlation Coefficient Between the Solar Wind Parameters and the Jovian Hectometric Emissions for the Time Period Displayed in Figure 3<sup>a</sup>

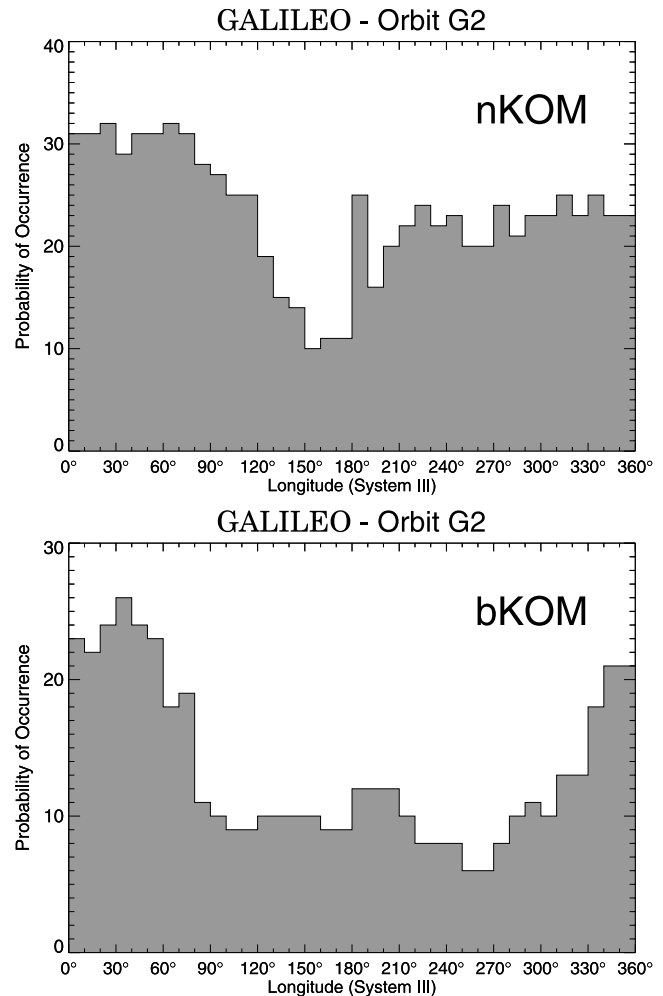
Solar Wind Parameters	Galileo		Wind	
	Correlation Coefficient	Delay, days	Correlation Coefficient	Delay, days
Flow speed	+0.62	153	+0.48	154
Ion density	−0.40	153	−0.38	153
Temperature	+0.56	154	+0.47	154

<sup>a</sup>The best correlation is obtained for a time lag of ~153 days.

ranges are followed by the increase of the HOM occurrence. This means that the “HOM events,” like the injections of particles, show similar features in longitude. We believe that both phenomena have the same origin, although it might be a coincidence fact. On the other hand, *Mauk et al.* [1999] found that the most probable radial position for injection events appears to be between 10 and 12  $R_J$ . Also the corresponding characteristic times of the injection events is close to one hour. These two features (i.e., radial position and the timescale) of the injection events are in disagreement with those derived from the “HOM events.” From our analysis, we show that such events occur during several days and could be observed at a distance bigger than 100  $R_J$ . The discrepancy can be explained by the way of production of the HOM and the injection events despite their common origin. The occurrence of the “HOM events” should be at higher latitudes than the injection ones. As it is well known, Jovian hectometric emissions are mainly generated in the auroral region of the Jovian magnetosphere [Kaiser, 1993]. This indicates that the solar wind effect is quasi-direct and therefore can generate “HOM events” which can be recorded very far from the planet and during several days. On the other side the injection events are locally measured by the EPD experiment and only during the time when Galileo spacecraft crosses the L shells where particles are injected.

#### 4.3. Hectometric and Kilometric Events

[18] Since Voyager investigations of the Jovian magnetosphere, another radio emission has been discovered: the so-called kilometric (KOM) radiation [Carr et al., 1983]. Three components were distinguished in that range: a broadband sporadic emission (bKOM), a smooth narrow-band radiation (nKOM) and a nonthermal trapped continuum within the magnetosphere. Using Galileo/PWS data, *Louarn et al.* [2000, 2001] attempted to describe the nature of the energetic events [Mauk et al., 1999] using the radio emissions as a diagnostic tool of the magnetospheric activity. *Louarn et al.* [2000] include several Galileo’s orbits as well as a part of the second orbit, i.e., from 9 September to 19 October 1996. The identification criteria for the energetic events is the simultaneity between an increase of the flux of the auroral radio emissions and the creation of a new source of nKOM. In this case, the flux of the auroral radio emissions is derived from the bKOM, HOM and DAM (decametric) emissions. This denotes that the authors did not make any distinction between these previous components, and only the nKOM is split from the other Jovian emissions. The authors show that the magnetospheric events are the consequence of two activations separated by a few hours. They occur in two separated longitude sectors and give rise to two different nKOM sources. In our analysis, we proceed to the study of occurrence probability of the three components: HOM, nKOM and bKOM. The HOM occurrence is shown in Figure 1 for both Galileo and Wind spacecraft. The Jovian kilometric emissions are only derived from Galileo observations and the probability of occurrence of the two components bKOM and nKOM is displayed in Figure 4. The frequency spectrum of the nKOM and bKOM emission is found in the range 20 kHz–200 kHz, and 5 kHz–800 kHz, respectively, [Boudjada and Galopeau, 2004]. As discussed in the previous subsection, the injection events



**Figure 4.** Occurrence probability, versus the central meridian longitude, of the Jovian narrow (nKOM) and broad (bKOM) band kilometric radiations recorded by Galileo/PWS during the orbit G2.

seem to be linked to two specific “longitudes” at 45° CML and 180° CML. From Figures 1 and 4, one can see that at the same longitudes, the Jovian hectometric emissions present an enhancement of probability of their occurrence and the nKOM occurrence shows a similar increase only at 180° CML. It comes from our analysis that the injection events are more correlated to the HOM and partially to the nKOM emissions.

#### 5. Conclusion

[19] Using observations of the Galileo/PWS and Wind/WAVES experiments we show that hectometric periodic enhancements related to the auroral regions take place in the Jovian magnetosphere. These phenomena are linked to the Jovian hectometric emissions which exhibit “HOM events” with a time duration of several days. Both spacecraft have almost recorded the same periodic enhancement despite the difference of distance to the planet and the coverage disparity in CML. Our analysis of these hectometric enhancements presents similar features in the longitude as those discovered by *Mauk et al.* [1999] in their study of the



“ejection” events recorded by the energetic particles detector (EPD) on board Galileo. The enhancement of the occurrence of the “ejection particles” or the “HOM events” begins at two specific longitudes, 45° CML and 180° CML. A recent study by Galopeau *et al.* [2004] shows that an active longitude may exist in Jupiter’s magnetosphere, specifically at high latitude where the so-called Jovian decametric emission (DAM) is generated. The authors calculated the maximum growth rate of the waves amplified by the cyclotron maser instability, and showed that some longitudes favor the radio decametric emission, leading to a higher occurrence probability.

[20] In our investigation, the “active longitudes” of the “ejection particles” and “HOM events” seem to have a same origin. A detailed examination of the fluctuations of the Jovian hectometric emission leads to a significant correlation between the HOM radiation and the solar wind parameters. Contrary to previous studies, we show that not only one parameter but several fundamental solar wind parameters (the flow speed, the temperature, and the ion density) are correlated to the hectometric emissions with a coefficient higher than 60% in the case of the flow speed. The time lag is found to be equal to 153 days which corresponds to a period from the 30 March to 25 May. During these weeks the minimum of the 22nd solar cycle was registered. This means that the Jovian magnetospheric disturbance could have started a few weeks before the increase of the solar activity. It seems that the particularly low level of the solar activity makes the interplanetary medium “more fluid” for the propagation of the solar particles. This result is in agreement with the storm occurrences taking place in the Earth’s magnetosphere. According to Richardson *et al.* [2001], the majority of intermediate strength storms are linked to streams at solar minimum, and to coronal mass ejections (CME) at solar maximum. The Earth and Jupiter seem to be subject to the same stream of solar particles which generate storm events in their magnetosphere. Further investigations must be made to understand, and possibly to predict, how the solar particles can generate, directly or indirectly, such disturbances and how they power the inner magnetosphere and also the planetary equatorial regions.

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M. Y. Boudjada, Abteilung für Physik des erdnahen Weltraums, ÖAW-Forschungszentrum Graz, Schmiedlstraße 6, A-8042 Graz, Austria. (mohammed.boudjada@oeaw.ac.at)

P. H. M. Galopeau, Centre d’Études des Environnements Terrestre et Planétaires, 10–12 Avenue de l’Europe, F-78140 Vélizy, France. (patrick.galopeau@cetp.ipsl.fr)